

Quality Systems Manual

***-Eastern States Consortium HDPEP Program-
CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, RI, VT, VA, NC***



Lane Enterprises, Inc.

**34 Strohm Rd.
Shippensburg, PA 17257
(717) 532-5959**

Submitted 2/23/2006

Note: Updated to include ESC revisions thru 9/27/2006

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

Table of Contents

I.	Policy Statement	3	
II.	Plant Information	3	
	A. Plant Address and Telephone #	3	
	B. Normal Hours of Operation	3	
	C. Holidays and Plant Closings	3	
III.	Personnel	4	
	A. Plant Manager	4	
	B. Quality Assurance Coordinator	4	
	C. Quality Assurance Supervisor	4	
	D. Quality Assurance Assistants	4	
	E. Production Foreman	4	
IV.	Manufactured Product List	5	
V.	Raw Materials	6-7	
	A. Virgin Polyethylene Resin	6	
	B. Carbon Black	7	
	C. Reworked Material	7	
	D. Fittings / Couplings	8	
	E. Purchased Components		8
VI.	Sampling: Method and Frequency	9	
	A. Method	9	
	1. Temperature recording	9	
	2. Humidity	9	
	B. Frequency	9	
	1. Minimum Inside Diameter	9	
	2. Liner Thickness	9	
	3. Length	9	
	4. Perforations	9	
	5. Pipe Stiffness	9	
	6. Pipe Flattening	9	
	7. Environmental Stress Crack Resistance	9	
	8. Brittleness	9	
	9. Joint Integrity	9	
VII.	Pipe Testing Procedures; Process Control	10-16	
	A. Weight	10	
	B. Workmanship and Marking	10-11	
	C. Dimensions	11-13	
	1. <i>Liner Thickness</i>	11	
	2. <i>Inside Diameter Tolerance</i>	12	
	3. <i>Length</i>	13	
	4. <i>Perforations-Water Inlet Area</i>	13	
	D. Pipe Stiffness and Flattening	14-15	
	E. Environmental Stress Crack Resistance (ESCR)	15	
	F. Brittleness	16	

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

G. Joint Integrity 16-17

Table of Contents (continued)

VIII. Procedures for Non-Conforming Product	17	
IX. Storage, Shipping and Handling of Finished Pipe	17-18	
X. Reporting	18	
XI. Specifying Agency Requirements	19	
XII. Testing Guidelines	19	
XIII. Statistical Process Control	19	
A. Production		
B. Quality Assurance		
XIV. Test Equipment	20	
XV. Qualification of Quality Control Personnel	20-21	
XVI. Annual Control Audit	21	
XVII. Statement of Assurance	21	
Appendix	22-43	
A. Q.A. Daily Worksheet		23
B. Mission Statement	25	
C. Q.A. Supervisor Resume	27	
D. Resin Test Form	29	
E. Certificate of Analysis		31
F. QC/QA Audit Report	32-41	
G. Laboratory Training / Competency Form	42-43	

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

I. Policy Statement

This program describes the organization, equipment, methods and procedures to assure that the HDPE pipe produced at the Shippensburg Plant meets or exceeds the highest requirements of AASHTO M-252 and M-294, applicable ASTM procedures, or the respective regulatory agency requirements in those states where Lane conducts business.

II. Plant Information

All High Density Polyethylene Pipe manufactured by Lane Enterprises, Inc. is manufactured and tested at the Shippensburg, Pennsylvania manufacturing facility.

A. Plant Address and Telephone Number

Lane Enterprises, Inc.
Plastic Pipe Division
34 Strohm Rd.
Shippensburg, PA 17257
Phone: (717) 532-5959
Fax: (717) 532-7997

B. Normal Business Hours

The Shippensburg, Pennsylvania manufacturing facility of Lane Enterprises, Inc. recognizes the hours of 8 A.M. to 5 P.M. on the days Monday through Friday as normal business hours.

C. Holidays and Plant Closings

The Shippensburg manufacturing facility of Lane Enterprises, Inc. observes the following holidays and plant closings, and will not be open for business on these days;

- New Year's Day – January 1
- Memorial Day – (Last Monday in May)
- Independence Day – July 4
- Labor Day – (First Monday in September)
- Thanksgiving Day – (Last Thursday in November)
- Day After Thanksgiving – (Last Friday in November)
- Christmas Holiday Season (Dec. 23-Jan.1)
- First Day of Buck Season – As Determined by the State of PA

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

III. Personnel

A. Plant Manager

The Plant Manager, Robert L. Diehl, is ultimately responsible to see that:

1. There is an overall focus, attitude and disposition to produce HDPE pipe consistent with the objective of this policy statement.
2. All plant employees understand that they each have the responsibility and authority to carry out their individual responsibilities in a manner that will result in production of quality pipe in conformance to this program.
3. That sufficient resources, in terms of equipment, personnel and training are made available to carry out the objective of this Q.A. Program.
4. This program is modified as necessary to respond to changes in external requirements such as changes in AASHTO, ASTM or applicable regulatory specifications.
5. The Production Supervisor is familiar with the responsibilities and competencies of that position.

B. Production Supervisor

The Plant Superintendent, Harry F. Shaw, is the Production Supervisor with overall responsibility for managing all production and directing the activities of all production personnel.

C. Quality Assurance Supervisor

The Quality Assurance Supervisor is responsible for all quality control testing and to see that all sampling and testing is done properly by qualified technicians. Through his signature on the daily Q.A. certified test results, the Q.A. Supervisor, Christopher L. Dull, attests that all phases of this quality control program are functioning properly. He has the authority to direct the Production Foreman to stop production if necessary and / or direct changes to production equipment in order to maintain product quality. This authority extends to all areas of production and is exceeded only by the Plant Manager. In the event of below standard product quality the Q.A. Supervisor and Q.A. Assistant handle the rejection of such material.

D. Quality Assurance Assistants

The designated Quality Assurance Assistants; Ronald E. Benner, Larry Diehl & Larry Sampson as directed by the Q.A. Supervisor, shall assist in performing tests, completing reports and maintaining records.

E. Production Foreman

The Production Foreman for each operating shift is responsible to the Q.A. Supervisor. He physically adjusts and tunes production equipment for speed, pressure, temperatures, etc. He is responsible to carry out his individual duties in a manner that will result in a quality finished product.

Lane Enterprises, Inc.
Quality Control // Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

IV. Manufactured Product List

The following products are manufactured at the Lane Enterprises, Inc. Shippensburg location;

Smooth Interior Corrugated Polyethylene Pipe (Type S)

150 mm (6 in.)	450 mm (18 in.)	1200 mm (48 in.)
200 mm (8 in.)	600 mm (24 in.)	
250 mm (10 in.)	750 mm (30 in.)	
300 mm (12 in.)	900 mm (36 in.)	
375 mm (15 in.)	1050 mm (42 in.)	

Smooth Interior Corrugated Polyethylene Pipe with Lok-Tite Bell Joint (Type S)

150 mm (6 in.)	450 mm (18 in.)	1200 mm (48 in.)
200 mm (8 in.)	600 mm (24 in.)	
250 mm (10 in.)	750 mm (30 in.)	
300 mm (12 in.)	900 mm (36 in.)	
375 mm (15 in.)	1050 mm (42 in.)	

Class I Perforated Smooth Interior Corrugated Polyethylene Pipe (Type SP)

150 mm (6 in.)	450 mm (18 in.)	1200 mm (48 in.)
200 mm (8 in.)	600 mm (24 in.)	
250 mm (10 in.)	750 mm (30 in.)	
300 mm (12 in.)	900 mm (36 in.)	
375 mm (15 in.)	1050 mm (42 in.)	

Class I Perforated Smooth Interior Corrugated Polyethylene Pipe with Lok-Tite Bell Joint (Type SP)

150 mm (6 in.)	450 mm (18 in.)	1200 mm (48 in.)
200 mm (8 in.)	600 mm (24 in.)	
250 mm (10 in.)	750 mm (30 in.)	
300 mm (12 in.)	900 mm (36 in.)	
375 mm (15 in.)	1050 mm (42 in.)	

Class II Perforated Smooth Interior Corrugated Polyethylene Pipe (Type SP)

150 mm (6 in.)	450 mm (18 in.)	1200 mm (48 in.)
200 mm (8 in.)	600 mm (24 in.)	
250 mm (10 in.)	750 mm (30 in.)	
300 mm (12 in.)	900 mm (36 in.)	
375 mm (15 in.)	1050 mm (42 in.)	

Class II Perforated Smooth Interior Corrugated Polyethylene Pipe with Lok-Tite Bell Joint (Type SP)

150 mm (6 in.)	450 mm (18 in.)	1200 mm (48 in.)
200 mm (8 in.)	600 mm (24 in.)	
250 mm (10 in.)	750 mm (30 in.)	
300 mm (12 in.)	900 mm (36 in.)	
375 mm (15 in.)	1050 mm (42 in.)	

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

V. Raw Materials

A. Virgin Polyethylene Resin

Objective: Only those resins approved and listed as third party approved on the PPI website (www.plasticpipe.org) shall be used in the manufacture of Lane pipe. All resin used to produce pipe are of cell class 335400C or higher, as specified in AASHTO M 294, section 6.1.1, and are accompanied by a Certificate of Analysis from the Resin Manufacturer certifying that the product does meet the specifications imposed by AASHTO M 294 (Appendix E). *No raw material will be utilized unless it has been tested and meets all requirements.* Materials having vendor certification must also undergo subsequent product verification testing to confirm that requirements have been met. All pipe produced can be traced back to the specific resin consumed.

Method: PE resin is normally received by railroad hopper car. Upon arrival, the Q.A. Supervisor shall open and visually inspect the material inside each railcar bin for obvious signs of contamination and then obtain a grab sample for testing to ensure specification compliance. In obtaining the grab sample, the Q.A. Supervisor shall first inspect the collection tool, or scoop, and the plastic bag used to store the sample to ensure that they are free from any contaminants. The Q.A. Supervisor shall then use the scoop to directly transfer the resin from the railcar to the plastic bag and shall seal the plastic bag to prevent contamination. The grab sample will be tested for melt index and density. No virgin resin will be used in the production process until it has been tested for specification compliance. After testing the resin, the results of the test will be filed by the Q.A. Supervisor with the manufacturers' Certificate of Analysis and will be kept on file for a minimum of 5 years. Any resin that is not in compliance will be removed and will not be acceptable for use within the production process. Each batch, i.e. Railcar, of resin is assigned a manufacturer's lot # for use in reporting and to establish the identity of the resin as it moves through the production process, testing phase and in the completion of the finished product.

Assurance:

1. Verify no visible signs of contamination or other abnormalities in size, consistency or color.
2. Grab sample is tested for melt index & density.
3. Verify documented results are equal to or higher than AASHTO or DOT requirements.
4. Test results are documented matched with the manufacturers' Certificate of Analysis and are kept on file in the testing laboratory by the QA/QC Supervisor for a minimum period of five years with respect to lot #, date, shift and time.

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

B. Carbon Black

Objective: To verify that all carbon black used shall meet specification for color and ultraviolet stabilization as defined in ASTM D 3350, except that the carbon black content shall not be greater than 5 % nor less than 2%, as stated in AASHTO M 294, section 6.1.1.

Method: Carbon black compound is received in Gaylord containers. Each shipment is accompanied by a Manufacturer's Certificate of Analysis to verify that the material within is in compliance with ASTM D 3350. The Gaylord shall be opened for examination and inspection by the Q.A. Supervisor.

Assurance:

1. Verify no visible signs of gross contamination or other abnormalities in size, consistency or color.
2. After at least one operating hour and on a daily basis from that time on, the Q.A. Supervisor shall determine the percent of carbon black to total resin consumption is between 2% minimum and 5% maximum.
3. At the end of the day, the Q.A. Assistant shall calculate the percent of carbon black to total resin consumed for the day and verify the percentage of 2% minimum and 5% maximum. The result is to be kept on file in the test lab and matched with respect to lot #, date, shift and time for a minimum period of five years.
 - *If at the end of the day, the carbon black content does not fall within the required range, the Q.A. Assistant shall immediately notify the Q.A. Supervisor of the problem. The two shall then work together to determine the cause and duration of the non-conformance. All material that is determined to be non-conforming shall be isolated and marked for rework.*

C. Reworked Material

Objective: To ensure that only clean reworked material is used in the manufacturing process provided it is from pipe produced from resins conforming to cell class 335400C or higher as is stated in AASHTO M 294, section 6.2.

Method: Only material that was verified as acceptable for production at Shippensburg will be reworked. No foreign materials will be reworked and used for production.

Assurance:

1. Operators responsible for reworking shall inspect the interior and exterior of each pipe to see that it is free from soil, dirt or other contaminants.
2. In the event of soiled or dirty pipe the Q.A. Supervisor determines if the pipe should be cleaned or scrapped.
3. Reworked material is stored in Gaylord containers while awaiting reuse.
4. Prior to consumption, the Q.A. Supervisor visibly inspects the reworked material to see that it is free from contaminants.

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

D. Fittings / Couplings

Objective: Only pipe that has been produced, tested and certified by Lane's Q.A. Supervisor, can be used in the fabrication of fittings. (tees, elbows, wyes, reducers, end caps, etc.)

Method: HDPE pipe that has been certified to meet AASHTO M 252 and / or AASHTO M 294 can be considered as raw material for the fabrication department.

Assurance:

1. Fabrication supervisor verifies that all pipe entering the fabrication department is clearly marked with the permanent AASHTO markings required in the pipe at the time of production.
2. In coming raw material (certified pipe) is logged in with the following data recorded: diameter, footage, lot number (for traceability).
3. Fabrication supervisor oversees all stages: saw cutting, hot plate welding, hand extrusion welding and marking of finished parts for compliance to AASHTO specifications.
4. Prior to placing finished parts into inventory, the fabrication supervisor completes consumption / production reports which can be used to trace finished fabricated parts back to raw materials.

E. Purchased Components

Objective: Any components (example = weld-on bell) must be certified by the vendor to meet the required AASHTO specification.

Method: All inbound shipments of purchased components must have a certification from the manufacturer, showing compliance to the appropriate AASHTO M 252 and/or AASHTO M 294 specification.

Assurance:

1. The Q/A supervisor verifies that all components are bar coded for traceability requirements (lot number, date of manufacture, etc.)
2. Certification papers are checked for part number, quantity, official signature and appropriate AASHTO specification.
3. Q/A supervisor verifies that a "Certificate of Analysis" for the raw material is attached to the signed certification, and that resin complies with AASHTO M 252 and/or AASHTO M 294.

Lane Enterprises, Inc.
Quality Control // Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

VI. Sampling: Method and Frequency

A. Method - Samples from each production lot, defined as 'production per type / per diameter / per machine / per production day', are selected at routine intervals to meet AASHTO testing requirements. Additional samples may be selected to satisfy further testing requirements as needed by the Q.A. Supervisor. All samples taken for the purpose of testing are to be conditioned according to AASHTO M 294, section 8, unless otherwise stated within the relevant AASHTO specification pertaining to that particular test. Samples shall be marked and recorded with the date and time that they were produced.

1. Temperature recording - The lab minimum and maximum temperature shall be logged at least three times for each 24 hour period on the Q.A Daily Worksheet to insure that the temperature falls within the required range.

- *If the laboratory temperature does not meet the range required by AASHTO M 294, section 8.1, the conditioning period shall start over for all existing samples as soon as and only after the temperature can be maintained within the required range of 21°C to 25°C (70° F to 77° F).*

2. Humidity - The lab minimum and maximum humidity shall be logged at least three times for each 24 hour period on the Q.A Daily Worksheet to insure that the humidity falls within the required range.

- *If the laboratory humidity does not meet the range required by AASHTO M 294, section 8.1, the conditioning period shall start over for all existing samples as soon as and only after the humidity can be maintained within the required range of 50% +/- 5% (45% to 55%) relative humidity.*

B. Frequency – The minimum frequency of the routine tests are as follows;

1. Minimum Inside Diameter- Test will be performed a minimum of one time per shift.
2. Liner Thickness- Test will be performed a minimum of two times per shift.
3. Length – Test will be performed a minimum of one time per shift.
4. Perforations – Test will be performed a minimum of one time per shift.
5. Pipe Stiffness – Test will be performed a minimum of two times per week.
6. Pipe Flattening- Test will be performed a minimum of two times per week.
7. Environmental Stress Cracking – Test will be performed one time per year.
8. Brittleness – Test will be performed a minimum of two times per week.
9. Joint Integrity – Test will be performed a minimum of one time per week.

Lane Enterprises, Inc.
Quality Control // Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

VII. Pipe Testing Procedures; Process Control

General: This section describes the Q.A. procedures performed to insure that pipe production is regularly and routinely evaluated to validate conformity with relevant AASHTO or ASTM specifications. Observations and tests are performed at the Shippensburg Plant, and all test results are signed and certified daily by the Q.A. Supervisor through his completion of the Q.A. Daily Worksheet.

A. Weight

Objective: To perform routine checks during the production process to allow for monitoring of the production process and the corresponding weight which can be directly correlated to the structural integrity of the finished product.

Method: The test for weight shall be performed on a minimum of three samples per shift. As each sample is cut from the production line it shall be weighed and measured in order to calculate the 'weight per foot'.

Assurance: The weight per foot value obtained from the sample shall be compared to traditional average weight per foot values to determine that the pipe being produced is consistent with the 'correct' weight and will thus possess the desired structural integrity.

- *If the weight per foot value is not consistent with the weight per foot value that is established as optimal, the Q.A. Supervisor shall be notified immediately and shall work in conjunction with the Production Foreman to correct the problem.*

B. Workmanship and Marking

Objective: To perform checks during and immediately after the production process to verify conformance with AASHTO M 294 with consideration to the terminology defined by ASTM D 883 and ASTM F 412.

Method: All Production personnel who handle and bundle finished pipe are responsible to visually check for adequate workmanship as defined by AASHTO M 294, section 7.1. The results of these checks are to be documented a minimum of six times per week per diameter on the Q.A. Daily Worksheet.

Assurance: Production personnel shall visually inspect each piece of pipe produced to determine that it conforms to AASHTO M 294, section 7.1, section 7.1.1 and section 7.1.2: That is to say that;

1. It is homogeneous throughout and uniform in color and opacity.
2. Free from cracks, creases (overlap), holes, blisters, voids, foreign inclusions or other defects visible to the naked eye that may affect wall integrity.
3. That the inner liner is fused to the outer corrugated wall.
4. That pipe ends are square cut, with cut end completely within the corrugation valley.

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

5. That every 20' length of pipe has at least two markings located not more than 10' (3.5m) apart and clearly showing: "LANE", the nominal size, the appropriate AASHTO designation and code for producing plant, week, day and shift produced. Each length of finished pipe shall include a date code marking which provides traceability to the lot from which it was produced.
 - *Any pipe not in conformance with all of the above criteria shall be immediately removed and marked for rework. The apparent reason and course of action for each failure shall be documented.*

C. Dimensions

Objective: Measure, record and compare physical attributes for conformity with AASHTO M 294, section 7.2.

Method: The Q.A. Supervisor, Q.A. Assistant or production personnel as directed, will perform measurements on finished pipe and pipe samples, and will record the data and compare to specification requirements to determine acceptance. (The number in parenthesis after each category references the specification governing that category found in AASHTO M 294).

1. Liner Thickness (7.2.2) – A test to measure the liner thickness will be performed a minimum of three times each shift. The test shall be performed on any sample that has been properly conditioned. This sample shall be measured at eight equally divided cross sections to facilitate measurement of the waterway wall and corrugation valley thickness as per ASTM D 2122. The values shall conform to that illustrated by the table that follows:
 - The thickness shall be acceptable provided it is equal to or greater than the values listed below.

<u>Nominal I.D.</u>		<u>Minimum Waterway Wall</u>	
inches / mm		inches / mm	
6"	150	0.020	0.50
8"	200	0.024	0.60
10"	250	0.024	0.60
12"	300	0.035	0.90
15"	375	0.039	1.00
18"	450	0.051	1.30
24"	600	0.059	1.50
30"	750	0.059	1.50
36"	900	0.067	1.70
42"	1050	0.071	1.80
48"	1200	0.071	1.80

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

- a. If the liner thickness measured does not conform, the Q.A. Supervisor shall be notified and further samples taken and measured until a minimum of three samples are in conformance.
 - b. Check each of the specimen pieces for the bond between the inner and outer wall with a probe or knife point. Pipe is in conformance if it is not possible to separate the two walls at the corrugation valley as per AASHTO M 294, section 7.1.2.
 - c. The results from each test will be documented and recorded by the Q.A. Supervisor on the Q.A. Daily Worksheet.
 - *If testing demonstrates that the pipe does not meet specification, the Q.A. Supervisor should be notified immediately and pipe produced on the corresponding day and shift is re-sampled. Those specimens shall be taken and retested in accordance with this section. The Q.A. Supervisor shall examine the results and determine the reason for the failure. If additional specimens being tested demonstrate conformance, the production for that shift shall be accepted; if not, the production shall be immediately removed and marked for rework. The cause and course of action for each failure shall be documented.*
2. Inside Diameter Tolerance (7.2.3.) - The inside diameter will be measured a minimum of one time per shift. The inside diameter will be 4.5% oversize and 1.5% undersize, but not more than 37 mm oversize (see chart). The inside diameter will be measured in accordance with AASHTO M 294, section 9.7.1. The results shall be documented and recorded on the Q.A. Daily Worksheet.

The average I.D. of the samples shall not be less than shown below:

<u>Nominal I.D.</u>	<u>Acceptable I.D.</u>	
	Min. *	Max. **
Inches / mm	inches / mm	inches / mm
6" 150	5.82 147.75	6.17 156.75
8" 200	7.76 197.00	8.23 209.00
10" 250	9.70 246.25	10.29 261.25
12" 300	11.63 295.50	12.34 313.50
15" 375	14.54 369.38	15.43 391.88
18" 450	17.45 443.25	18.51 470.25
24" 600	23.27 591.00	24.69 627.00
30" 750	29.09 738.75	30.86 780.00
36" 900	34.90 886.50	36.61 930.00
42" 1050	40.72 1034.3	42.52 1080.00
48" 1200	46.54 1182	48.43 1230.00

* Nominal diameter less 1.5 %

** Nominal diameter plus 3.0% but not more than 37mm

Note: AASHTO M294 calls for the average of 2 samples measured at 8 points spaced equally around the circumference.

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

- *If testing demonstrates that the pipe does not meet specification, the Q.A. Supervisor should be notified immediately and pipe produced on the corresponding day and shift is re-sampled. Those specimens shall be taken and retested in accordance with this section. The Q.A. Supervisor shall examine the results and determine the reason for the failure. If additional specimens being tested demonstrate conformance, the production for that shift shall be accepted; if not, the production shall be immediately removed and marked for rework. The cause and course of action for each failure shall be documented.*
3. Length (7.2.4) - The length shall be measured a minimum of one time each shift. The measurement shall be taken along the invert of a pipe that has cooled to ambient temperature while resting stress-free on a flat surface in a straight line. A nominal 20' length shall be acceptable if the recorded length is 19' 9.6" or greater.
- *If the measured length is less than the minimum, the measured length shall be marked on the outside of the pipe and the pipe set aside for disposition by the Q.A. Supervisor. Measurements should be made on all subsequent pipes until a minimum of three consecutive measures are in conformance to the specification.*
- Note: The minimum acceptable length is based on aim length x .99.
4. Perforations (7.3) - All perforated pipe shall be created and tested with regard to AASHTO M 252, section 7.4 and AASHTO M 294, section 7.3, depending on the nominal diameter of the pipe. Perforated pipe will be tested a minimum of once per shift to determine conformance. The results shall be recorded by the Q.A. Supervisor on the Q.A. Daily Worksheet.
- a. Water Inlet Area- The Water Inlet Area of all perforated pipe will be determined as follows: for pipe with the diameter of 6" (150 mm), 8" (200 mm) and 10" (250 mm) perforations are determined by AASHTO M 252, section 7.4.1 (Class 1) and section 7.4.2 (Class 2); for diameters 12" (300 mm), 15" (375 mm), 18" (450 mm), 24" (600 mm), 30" (750 mm), 36" (900 mm), 42" (1050 mm) and 48" (1200 mm) perforations are determined by AASHTO M 294, section 7.3.1 (Class 1) and section 7.3.2 (Class 2).
- *If testing on perforated pipe (Class I or Class II) demonstrates that the pipe does not meet specification, the Q.A. Supervisor should be notified immediately and pipe produced on the corresponding day and shift is re-sampled. Those specimens shall be taken and retested in accordance with this section. The Q.A. Supervisor shall examine the results and determine the reason for the failure. If additional specimens being tested demonstrate conformance, the production for that shift shall be accepted; if not, the production shall be immediately removed and marked for rework. The cause and course of action for each failure shall be documented.*

Lane Enterprises, Inc.
Quality Control // Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

D. Pipe Stiffness and Flattening

Objective: Determine conformance to specification through in-plant parallel plate testing as defined by AASHTO M 294, section 7.4 (pipe stiffness) and section 7.5 (pipe flattening).

Method: The pipe stiffness and pipe flattening test shall be performed by the Q.A. Supervisor or Q.A. Assistant a minimum of two times each week under the following conditions:

1. Each of the two tests will be performed on three specimens, for a minimum of six test values per week.
 - a. Specimen Orientation: The three specimens for each test shall be oriented in the test apparatus so that the mold seam is oriented as follows:
 - Specimen # 1- Position at 0 degrees
 - Specimen # 2- Position at 45 degrees
 - Specimen # 3- Position at 90 degrees
2. The length of the test specimen shall be at least equal to the nominal I.D., but not less than 12".
3. Specimens will be properly conditioned as per AASHTO M 294, section 8.1.
4. The test will be performed as per ASTM D 2412 except as specified in AASHTO M 294, section 9.1.

Assurance: Upon the completion of the stiffness test, after the vertical inside diameter of the sample has been deflected by 5%, the Q.A. Supervisor or the Q.A. Assistant shall carefully examine and record the following;

1. The temperature and humidity of the testing lab during the testing of each sample shall be recorded on the Q.A. Daily Worksheet.
2. The stiffness of each of the three specimens tested shall be recorded and shall not be less than the following;

<u>Nominal I.D.</u>		<u>Minimum PS at 5 Percent</u>
<u>inches</u>	<u>mm</u>	<u>lb./in./in</u>
6	150	50
8	200	50
10	250	50
12	300	50
15	375	42
18	450	40
24	600	34
30	750	28
36	900	22
42	1050	20
48	1200	18

The result of the test is documented and recorded by the Q.A. Supervisor on the Q.A.

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

Daily Worksheet.

- *If testing demonstrates that the pipe does not meet specification, the Q.A. Supervisor should be notified immediately and pipe produced on the corresponding day and shift is re-sampled. Those specimens shall be taken and retested in accordance with this section. The Q.A. Supervisor shall examine the results and determine the reason for the failure. If additional specimens being tested demonstrate conformance, the production for that shift shall be accepted; if not, the production shall be immediately removed and marked for rework. The cause and course of action for each failure shall be documented.*

Upon completion of the pipe stiffness test, each specimen shall be flattened, at the same rate, until the vertical inside diameter is reduced by 20%. The specimen shall pass if no cracking, splitting, wall buckling or separation of the outer waterway wall from the inner waterway wall is observed under normal light with the unaided eye.

- *If any of the specimens fail the flattening test, the same procedure shall be followed that is described for failing the pipe stiffness test. The result of the pipe flattening test is documented and recorded by the Q.A. Supervisor on the Q.A. Daily Worksheet.*

E. Environmental Stress Crack Resistance

Objective: Determine conformance to the environmental stress-cracking specification detailed in AASHTO M 294, section 7.6.

Method: The Q.A. Supervisor or Q.A. Assistant is responsible to conduct and record the results of these tests under the following conditions:

1. The test shall be performed on three specimens a one time per each week.
2. Each test specimen shall be a 90-degree arc length of pipe.
3. The test specimens are to have the inside chord length reduced by 20% and held in this position for 24 hours while completely submerged in the IGEPAL CO-630 wetting agent that is to be controlled at a temperature of 50°C +/- 2°C.

Assurance: The Q.A. Personnel shall remove the specimen and inspect immediately for any visible cracks. The results are recorded by the Q.A. Supervisor on the Q.A. Daily Worksheet.

- *If testing demonstrates that the pipe does not meet specification, the Q.A. Supervisor should be notified immediately and pipe produced on the corresponding day and shift is re-sampled. Those specimens shall be taken and retested in accordance with this section. The Q.A. Supervisor shall examine the results and determine the reason for the failure. If additional specimens being tested demonstrate conformance, the production for that shift shall be accepted; if not, the production shall be immediately removed and marked for rework. The cause and course of action for each failure shall be documented.*

Lane Enterprises, Inc.
Quality Control // Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

F. Brittleness

Objective: Determine brittleness of pipe through in-plant impact testing and conformance to AASHTO M 294, section 7.7.

Method: The Q.A. Supervisor or Q.A. Assistant is responsible to conduct and record the results of these impact tests as specified in AASHTO M 294, section 9.3:

1. The test for brittleness shall be performed three times per week.
2. Each test will consist of either six specimens - one for each impact, or one specimen for all six impacts.
3. Test specimens shall be a length equal to the inside diameter of the pipe and not less than 600 mm (24") when using one specimen for all six impacts.
4. Six impacts created by a mass of 4.5 kg (10 lbs.) falling from a height of 3.0 m (10') are to be performed in total.
5. Test specimens are to be conditioned in a controlled environment with a temperature of $-4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 24 hours.
6. Impact points are to be a minimum of 150 mm (6 in.) from the end of the specimen
7. Successive impacts shall be separated by 120 ± 10 degrees for impacts made on one circle, or at least 300 mm longitudinally for impacts made on one element.

Assurance: The Q.A. Personnel shall remove the specimen from the impact tester and inspect immediately for any splits or cracks. The results of the test shall be recorded by the Q.A. Supervisor on the Q.A. Daily Worksheet.

- *Five non-failures out of six impacts will be acceptable. If the result is less than five non-failures, the lot shall be quarantined, re-sampled and re-tested to prove conformance. All Pipe found not in conformance shall be immediately marked for rework and moved to the reworked material area. The apparent cause and course of action for each failure shall be documented.*

G. Joint Integrity

Objective: Test for assurance that joints or fittings do not reduce or impair the overall integrity or function of the pipe line as stipulated by AASHTO M 294, section 7.8.

Method: A minimum of one time per week, the Q.A. Supervisor or Q.A. Assistant is responsible to perform the test for joint integrity as per AASHTO M 294, section 9.6;

1. Pipe samples shall be at least 300 mm in length, or 600 mm in length when the samples are properly connected, with the connection at the center of the specimen.
2. Using the parallel plate tester, the specimen shall be reduced by at least 20% of the nominal diameter of the pipe at a rate of 12.5 mm per minute.

Assurance: Upon completion of the test, the Q.A. Supervisor or Q.A. Assistant shall examine joints and fittings for the following;

1. The fitting shall not reduce the overall length by a value greater than 12 mm.
2. The fitting shall not reduce the inside diameter of the pipe being joined by more than 12 mm.

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

3. Couplings shall be corrugated to match pipe corrugations, and shall provide sufficient longitudinal strength to preserve pipe alignment and prevent separation at the joints.
4. The pipe connection shall not separate to create a gap exceeding 5 mm when measured in a radial direction between pipe and coupling, or between bell and spigot portions of the pipe when tested using the parallel plate tester as per AASHTO M 294, section 9.6.2.
5. The fitting shall not crack or delaminate when tested using the parallel plate tester as per AASHTO M 294, section 9.6.2.
 - *If the joint measured does not meet these requirements, the Q.A. Supervisor shall be notified immediately and pipe produced on the corresponding day and shift is re-sampled. Those specimens shall be taken and retested in accordance with this section. The Q.A. Supervisor shall examine the results and determine the reason for the failure. If additional specimens being tested demonstrate conformance, the production for that shift shall be accepted; if not, the production shall be immediately removed and marked for rework. The cause and course of action for each failure shall be documented.*

VIII. Procedures for Non-Conforming Product

Objective: To insure that all non-conforming product is identified and properly removed.

Method: Any material that is tested in accordance with, and does not meet the specification of a test found in AASHTO M 252, AASHTO M 294 or a relevant ASTM specification (i.e. a test failure) will be considered to be a non-conforming product. That lot or product may be re-sampled and re-tested to establish that it is a non-conforming product as per AASHTO M 294, section 10.2. All non-conforming product will be removed and marked for rework unless otherwise stipulated by this program within the respective test section. The apparent cause and course of action shall be documented for each failure and shall be addressed on the Q.A. Daily Worksheet.

Assurance: All employees are instructed by the Q.A. Supervisor as to the manner of disposal of all non-conforming products. All individuals at all stages of production and handling have the responsibility and ability to report or remove non-conforming products.

IX. Storage, Shipping and Handling of Finished Pipe

Objective: To ensure that products be handled and shipped in a manner that will prevent damage or defects from occurring during the handling, storage and transportation process.

Method: All pipe shall be bundled with care, handled properly and will be clearly marked with the manufacturers name, nominal size, "M294", plant designation code, and date code.

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

Assurance:

1. When the pipe is produced and it is determined that the pipe does meet all of the necessary requirements, the pipe is marked by applying a 'Third Party Approved' sticker. This signifies that this pipe has been tested and does meet the necessary requirements. Only pipe that has been examined and is determined to be in conformance with all requirements shall be marked and bundled.
2. Pipe shall be bundled in secure fashion to prevent rolling during handling and shipment.
3. Bundles are carefully handled by forklift and are stored by diameter in a manner that will prevent any damage or defects from occurring while the pipe awaits shipment. During the handling process, only those employees designated and trained as fork-lift operators shall handle finished pipe.
4. During shipment, all loads are required to be securely fastened and a signed bill of lading shall be required from the shipper stating such.

X. Reporting

Objective: To completely match all test results from each phase of production to insure that all pipe produced is of the highest quality and meets all relevant AASHTO, ASTM, or applicable DOT specifications and that the results of all tests were reported accurately and completely. Unless requested at the time of ordering, test reports do not have to be filed for specific projects.

Method: It is the responsibility of the Q.A. Supervisor through his signature on the Q.A. Daily Worksheet (Appendix A) to verify that all necessary test procedures were carried out correctly and that all tests were performed according to the relevant specifications and reported accurately and completely.

Assurance: After completing and examining all test procedures and results, the Q.A. Supervisor will complete and sign the Q.A. Daily Worksheet signifying that all testing procedures were completed and the results are accurate for each production day. The Q.A. Daily Worksheet is filed by the Q.A. Supervisor in the testing laboratory with respect to date, shift and time so the Q.A. Daily Worksheet can be matched with all raw material test results. This enables the Q.A. Supervisor to prove compliance to the relevant specifications from the beginning of the production process to the end. All reports shall indicate the action taken to resolve resin or product failures. All test results are kept on hand for a minimum of five years and shall be made available to the specifying agency upon request.

Lane Enterprises, Inc.
Quality Control // Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

- XI. Specifying Agency Requirements** - The Q.A. Supervisor shall be responsible for maintaining a record of all ESC, State DOT, NTPEP or other specifying agency review, action taken or reports issued with respect to this Quality Control Program. Lane shall also be responsible to supply the necessary pipe samples required to achieve compliance with the ESC and NTPEP protocol. For ESC, a minimum of two samples per M 294 for each year shall be selected, split and tested by the manufacturer and by the specifying agency. All records shall be kept on hand for a minimum of five years and shall be made available to the respective specifying agency upon request. The annual split sample results from the independent laboratory and the pipe manufacturer will be compared and then posted to the standard format provided on the ESC website, <http://www.nh.gov/dot/espc/library.htm>. Any significant differences will be addressed with corrective action noted.
- XII. Testing Guidelines** - All test procedures performed at Lane Enterprises' - Shippensburg location - are completed as specified within the relevant AASHTO, ASTM, or applicable DOT specifications. A current 'Standard Operating Procedures' binder containing the most recent version of all specifications referenced in this Quality Control Program along with an updated version of the Quality Systems Manual (QSM) are kept on hand and are available to all laboratory and production personnel for consultation.
- XIII. Statistical Process Control** - Lane Enterprises utilizes Statistical Process Control information to monitor both production and QA tests and results.
- A. Production** - Statistical Process Control plays a large role in the production process. During the production process, Lane tracks numerous production factors such as but not limited to; pressure, mold block temperature, mandrel temperature, water bath temperature, melt index, density, average inside diameter, average weight per foot, average pounds per hour and all production problems or stoppages. As this data is gathered, Lane is able to isolate factors and conditions that are conducive to producing a desired product and those that will inhibit the production of a desired product so as to be able to control certain factors and create the most efficient production environment possible.
- B. Quality Assurance** – Lane Quality Control Personnel constantly monitor and track the results from all Q.A. testing performed at the Shippensburg Manufacturing Facility. For each test, QA Personnel examine and record physical properties associated with each sample. In tracking these physical properties such as; size, inside diameter, outside diameter, weight per foot, liner thickness and material distribution, it is possible to compare variation in these factors. When coupling these factors with production properties, personnel are able to attribute failure, weaknesses or flaws in the finished product with variation in certain inputs.

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

XIV. Test Equipment - All test equipment is properly maintained and maintenance activities shall be documented (i.e. certificate of calibration) and will be made available to appropriate personnel upon request. The following equipment is utilized in the testing performed at Lane Enterprises and is calibrated with the listed frequency:

Test Equipment	Manufacturer	Information	Calibration
Digital Compression Machine (Parallel Plate Tester)	Plowman Brothers Industries	LO-TES Test Machine, Model LT-10	Annually
Scale	Pennsylvania Scale Co.	200 lbs. - .05lbs.	Annually
Balance	A&D	60g-.01mg	Annually
Digital Ultrasonic Thickness Gauge	Panametrics	Model 25	Annually
Type K Thermocouple Thermometer	Digi-Sense	General Purpose Probe, -50 to 1999 degrees F.	Annually
Digital Calipers	Mitutoyo	0 to 150mm (0" to 6")	Annually
Vernier Calipers	Shars	0 to 600 mm (0" to 24")	Annually
Vernier Calipers	Shars	0 to 1000 mm (0" to 40")	Annually
Vernier Calipers	Chicago Brand	0 to 1500 mm (0"-60")	Annually
Certified Tape Measure	Starrett	12 ft.	Certified to NIST

XV. Qualification of Quality Control Personnel - The Q.A. Supervisor is charged with the laboratory qualification/training program and has been trained and certified in the following;

- Developing Shop Floor Instructions and Procedures – Turnkey Manufacturing Seminars.
- Plastics Processing and Manufacturing – Pennsylvania College of Technology
- Plastic Material Selection & Testing – Pennsylvania College of Technology
- Extrusion Seminar and Hands - On Workshop – Pennsylvania College of Technology.
- Dynisco Polymer Test LMJ series melt indexer – Dynisco Polymer Test

It is, therefore, the responsibility of the Q.A. Supervisor to properly instruct and train all personnel performing laboratory testing when necessary, be it due to a new test procedure or a revision to a specification detailing an existing procedure. All quality control personnel shall be familiar with the tests they perform and have sufficient authority to

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

assure that corrective actions are carried out when necessary. All quality control personnel shall report to the Q.A. Supervisor who shall have direct authority over all quality control personnel. (see appendix G for “Laboratory Training / Competency Form”)

- *It is the responsibility of management to audit on an annual basis the Quality Control Program and Quality Control Supervisor to ensure that the individual is qualified and is performing his duties as is specified within this program (Appendix F: See Annual Quality Control / Quality Assurance Program Audit Report).*

XVI. Annual Control Audit

The management of Lane Enterprises, Inc. performs, on an annual basis or as necessary, their Quality Control Audit. During this Audit, an examination of plant/facility and equipment, raw material sampling and control, pipe sampling, test procedures and frequencies, quality reporting and documentation and all non-conforming procedures shall be conducted. Additionally, all current specifications and industry practices shall be examined and the Standard Operating Procedures (SOP) binder shall be updated as necessary. Finally, routine monthly management meetings are held to review existing and consider the development of better and more efficient methods to enhance production and quality within the manufacturing and quality control processes.

- XVII. Statement of Assurance** – Lane Enterprises’ Shippensburg manufacturing facility values quality and believes strongly in producing a quality product. Through its’ participation in the PPI Third Party Certification Program, Lane demonstrates that it is serious about producing a product consistent with industry specifications and standards. Under this program, it is understood that the specifying agency (i.e. D.O.T. representative or other relevant inspector) may require samples of materials and shall be granted access to the manufacturing facility to inspect manufacturing and quality control operations. Furthermore, through the creation of, adherence to, and constant effort toward improving this Quality Control Plan, Lane is confident that all products are in accordance with or exceed necessary AASHTO, ASTM, relevant DOT and Third Party specifications. This Quality Control Plan is accurate, updated and is enforced.

APPENDIX A

Q.A. Daily Worksheet

HDPE PIPE- AASHTO M252/M294

COMPLETION DATE _____

STOCKLOT DATE CODE _____

DIAMETER _____

TYPE _____

NUMBER OF PIECES _____

D.O.T. NUMBER _____

(S,SP,C OR CP)

LINE NUMBER _____

LOT NUMBER _____

PRODUCTION DATE _____

SPECIMEN #1

SPECIMEN #2

SPECIMEN #3

RESIN CAR # _____

CARBON BLACK LOT # _____

(6.1) CARBON BLACK % COMPLIANCE

PASS _____

FAIL _____

(7.1) WORKMANSHIP &

MARKING PASS _____

FAIL _____

PASS _____

FAIL _____

PASS _____

FAIL _____

(7.2.3) INSIDE DIAMETER

1 _____

5 _____

1 _____

5 _____

1 _____

5 _____

(1 TEST) INSIDE DIAMETER

2 _____

6 _____

2 _____

6 _____

2 _____

6 _____

/ SHIFT) INSIDE DIAMETER

3 _____

7 _____

3 _____

7 _____

3 _____

7 _____

INSIDE DIAMETER

4 _____

8 _____

4 _____

8 _____

4 _____

8 _____

AVERAGE= #DIV/0!

AVERAGE= #DIV/0!

AVERAGE= #DIV/0!

(7.2.2) LINER THICKNESS

1 _____

5 _____

1 _____

5 _____

1 _____

5 _____

(3 TESTS) LINER THICKNESS

2 _____

6 _____

2 _____

6 _____

2 _____

6 _____

/ SHIFT) LINER THICKNESS

3 _____

7 _____

3 _____

7 _____

3 _____

7 _____

LINER THICKNESS

4 _____

8 _____

4 _____

8 _____

4 _____

8 _____

AVERAGE= #DIV/0!

AVERAGE= #DIV/0! 0

AVERAGE= #DIV/0!

(N/A) O.D. _____

(9.1) SAMPLE LENGTH _____

AVERAGE= #DIV/0!

AVERAGE= #DIV/0!

AVERAGE= #DIV/0!

(1/SHIFT) WT./FOOT _____

(8.1) LAB TEMP. _____

(8.1) HUMIDITY _____

(7.4) STIFFNESS

0 DEGREES

45 DEGREES

90 DEGREES

(2 TESTS) PRELOAD= _____

/ WEEK) 5% DEFLECTION _____

(7.5) FLATTENING _____

(2 TESTS) 20% DEFLECTION

PASS _____

FAIL _____

PASS _____

FAIL _____

PASS _____

FAIL _____

/ WEEK)

9.7.2 LENGTH

(1 TEST / SHIFT)

PASS _____

FAIL _____

(9.4) ESCR

(1 TEST/WEEK)

#1 PASS _____

FAIL _____

#2 PASS _____

FAIL _____

#3 PASS _____

FAIL _____

(9.3) BRITTLENESS

(3 TESTS / WEEK)

IMPACT #1 PASS _____

FAIL _____

IMPACT #2 PASS _____

FAIL _____

IMPACT #3 PASS _____

FAIL _____

IMPACT #4 PASS _____

FAIL _____

IMPACT #5 PASS _____

FAIL _____

IMPACT #6 PASS _____

FAIL _____

9.7.3 PERFORATIONS

(1 TEST/SHIFT)

DIA. _____

CLASS _____

HOLE SIZE _____

PASS _____

FAIL _____

HOLE LOCATION (LEFT) _____

(RIGHT) _____

9.6.1 JOINT INTEGRITY

(1 TEST/WEEK)

PASS _____

FAIL _____

COMMENTS: _____

* ALL SAMPLES HAVE BEEN TESTED IN ACCORDANCE WITH SPECIFICATIONS AND ALL REQUIREMENTS WERE MET.

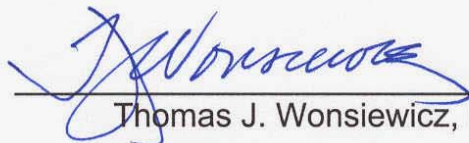
Q.A. SUPERVISOR

APPENDIX B

Quality Control Mission Statement

Quality Control Mission Statement

Our mission is to consistently produce a product in conformance with all applicable AASHTO, ASTM or regulatory agency requirements through the development of superior production techniques, as a result of our dedicated, competent employees and in the utilization of stringent Quality Control procedures. Our goal is to produce a finished product that is synonymous with the highest quality and one that is equal to the best in the industry.



Thomas J. Wonsiewicz, President

APPENDIX C

Q.A. Supervisor Resume

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

(Document removed for posting on the ESC website)

APPENDIX D

Resin Test Form (In-House)

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

Raw Materials: Resin Test for Melt Index and Density

Melt Index			
MI Model # 4002		Serial # 9063	
Method:	A	Melt Time:	390 sec.
Temp:	190 deg C	Method A Time:	360 sec.
Load:	2.16 Kg	* calibrate with known material on start-up	
* Control Material Dowlex 2045 LLDPE --- MFR = 1.15 +/- .05 g/10 min.			
SAMPLE	Mass of Extrudate	Melt Index Mult.	+ Melt Index Value
		1.67	
BIN #1		1.67	
BIN #2		1.67	
BIN #3		1.67	
BIN #4		1.67	
+ Melt Index Value must be within .4 - .15 as per AASHTO M 294.			

Results			
Car #	0	Avg. Melt Index	<u>0.0000</u>
Lot #		Density	<u>#DIV/0!</u>
Date	0/00/00	NCLS Value	

Density				
Sample	Unknown Pellets	Known Beads	* Density of UnKnown Pellets	Density of Known Beads
#1			<u>#DIV/0!</u>	0.93953
#2			<u>#DIV/0!</u>	0.9447
#3			<u>#DIV/0!</u>	0.9498
#4			<u>#DIV/0!</u>	0.955
#5	X	X		0.9596
* Density must fall with .945 gm/cc - .955 gm/cc as per AASHTO M 294				

APPENDIX E

Resin Supplier Certificate of Analysis (C.O.A.)

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

Date: 8/25/2003 Time: 11:58 AM To: @ 17175327997
Page: 002-002

Equistar Chemicals, LP
One Houston Center
1221 McKinney
Houston TX 77010

Certificate Of Analysis

Certificate of Analysis Contact:
BOB DIEHL
34 STROHM RD.
SHIPPENSBURG PA 17257
Fax No. : 717-532-7997

Ship-To Address:
LANE ENTERPRISES INC
34 STROHM RD.
SHIPPENSBURG PA 17257
USA

Equistar Material : 8880 ALATHON® L5332CP
Batch Number : MT23072622
Vehicle Number : EQUX630218
Estimated Quantity : 184,050 LBS

Customer Order No. : 12-0498 RLD
Customer Number : 41559
Date Shipped : August 25, 2003
Equistar Order No. : 785430 000010
Delivery Item No. : 80976841 000010

Test Description	Test Result	Unit of Measure
Vehicle ID	EQUX630218	
Vehicle Type	HOPPER CAR	
Density @ 23C	0.952	g/cc
Melt Index, 2160g @ 190C	0.37	g/10 min.

Meets Cell Classification 335430A & AASHTO M294

Approved by:

R. Michael Kennedy

R. Michael Kennedy, Quality Coordinator

Print Date: August 25, 2003 CGCALVIL
This information is available 24 hours a day at
www.CustomerXPRESS.com
Questions ? Call Customer Service: 888-777-0232

This Certificate of Analysis contains the most current information available as of the print date.
This document shall not be reproduced except in full, without the written approval of the issuer.

APPENDIX F

Annual Quality Control / Quality Assurance Program Audit Report

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

Lane Enterprises - Annual Control Audit of the Quality Assurance / Quality Control Program

Purpose: At the end of each calendar year, the management of Lane Enterprise's Shippensburg manufacturing facility shall address the effectiveness of the Quality Control Program. This audit shall consist of the examination of Quality Assurance / Quality Control (QA/QC); personnel, equipment, testing procedures, reporting procedures and specifying agency or industry requirements.

Method: The audit is performed on the respective competency / aspect of the Q.A. / QC program by the auditors based upon the statements or questions found herein. The auditor shall then rate the subject (i.e. personnel, equipment, and procedure) of the question by assigning to it a value, those values shall be assigned with respect to the following scale;

*1. = Poor *2. = Below Average 3. = Average 4. = Above Average 5. = Excellent

** Any assigned value of 2 or below indicates that action must be taken to improve that subject. The action necessary to improve the negative rating shall be detailed in the 'Comments' section. Additional comments explaining the assigned value for all values may be included.*

I. Personnel:

Q.A. Supervisor: Name: Christopher L. Dull

Method: Observed test procedures, examined organization of records and past results.

Audit Result:

- The Q.A. Supervisor is responsible for quality control personnel, testing and all reporting associated with this program.

1 2 3 4 5

Comments: The Q.A. Supervisor continues to manage the Q.A. /Q.C. Program thoroughly. All technicians are continually monitored by the Q.A. Supervisor to ensure that all procedures and test methods are being performed timely and accurately. All test results are individually reviewed by the Q.A. Supervisor and then maintained for a minimum of 5 years. The Q.A. Supervisor does an outstanding job.

- The Q.A. Supervisor demonstrates a thorough knowledge of all AASHTO and ASTM specifications and is proficient in performing all test procedures.

1 2 3 4 5

Comments: The Q.A. Supervisor keeps a binder of all of the relevant AASHTO and ASTM specifications in the testing laboratory. The Q.A. Supervisor is familiar with all of the relevant specifications and can consult the SOP binder when necessary. The Q.A. Supervisor is responsible to update each specification when a change or revision to a specification is issued.

- The Q.A. Supervisor is familiar with all test equipment and exhibits a working knowledge of the proper operation of all equipment for each test.

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

1 2 3 4 5

Comments: The Q.A. Supervisor is able to operate and instruct others on the operation of each piece of testing equipment.

- The Q.A. Supervisor properly trains all Q.A. personnel with regard to the proper test procedure.

1 2 3 4 5

Comments: The Q.A. Supervisor trains all personnel and requires all personnel to have an established and demonstrated understanding of each test procedure before actually allowing them to perform that test. Additionally, the Q.A. Supervisor performs frequent audits of all tests / personnel. Anytime a revision in a specification causes a change in the actual test procedure, the Q.A. Supervisor instructs all personnel as to that change.

- The Q.A. Supervisor is responsible to sign the Q.A. Daily Worksheet for each day indicating that all test procedures were performed correctly and all results are accurate.

1 2 3 4 5

Comments: The Q.A. Supervisor signs each Q.A. Daily Worksheet after checking and verifying all test results.

- The Q.A. Supervisor is responsible to assign all raw materials a lot number. That lot number is to be documented through the production process and shall be displayed on the Q.A. Daily Worksheet for that pipe.

1 2 3 4 5

Comments: The Q.A. Supervisor assigns a lot# for each batch / railcar of virgin resin and uses the manufacturers' lot# for carbon black.

- The Q.A. Supervisor shall be responsible to file all; material / vendor certifications, test results, and equipment calibration, inspection or audit results in a neat and orderly fashion so that any test report from the last five years can be located and examined if necessary.

1 2 3 4 5

Comments: The Q.A. Supervisor was able to produce upon request all; resin manufacturer certificate of analysis, Q.A. Daily Worksheets, certificates of equipment calibration and Third Party or D.O.T. audit or inspection results.

- The Q.A. Supervisor is responsible to document all test failures or non-conformances, the reason for the failure and the remedy or action taken to correct the problem.

1 2 3 4 5

Comments: The Q.A. Supervisor keeps a defective pipe log in the testing laboratory.

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

Q.A. Technicians: **Ronald Benner, Larry Diehl and Larry Sampson.**

Method: Observed testing procedures and examined records and past results.

Audit Result:

- All Q.A. Technicians demonstrate that they have been properly trained and follow the proper procedures and instructions when performing each sampling / test procedure.

1 2 3 4 **5**

Comments: All personnel who were observed performed all test procedures properly.

- All Q.A. Technicians demonstrate that they are familiar with the equipment necessary for that individual to perform the test procedure they are required to perform.

1 2 3 **4** 5

Comments: All personnel demonstrated that they possessed sufficient knowledge to carry out all test procedures properly, although some personnel were not sure how to calibrate the equipment or fix problems that arose. In those instances, they must rely upon the Q.A. Supervisor.

- All Q.A. personnel correctly and accurately record and report all test results to the Q.A. Supervisor.

1 2 3 4 **5**

Comments: All Q.A. Daily Worksheets appeared to be accurate and all contained the signature of the Q.A. Supervisor indicating that the tests were performed correctly and all test results were accurate.

- Q.A. personnel correctly record, follow proper procedure and immediately notify the Q.A. Supervisor upon discovering an area of non-conformance with respect to the Q.A. / Q.C. program or procedure.

1 2 3 4 **5**

Comments: Although no such instance was witnessed, all Q.A. Technicians were able to verbally provide assurance that they know what procedure to follow if a failure occurred.

- Q.A. personnel understand that they have the responsibility and authority to report and remove any non-conforming product.

1 2 3 **4** 5

Comments: All Q.A. personnel knew the proper procedure in such a situation, but most said that they would consult the Q.A. Supervisor before taking any action to fix the problem.

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

II. Equipment:

Method: Check all equipment calibration certificates and compare current test data to historical test data to make sure that all test equipment is working sufficiently.

Audit Result:

Digital Compression Machine (Parallel Plate Test Machine)	Last Calibration 3/29/05
200lb. Scale	Last Calibration 9/28/05
Digital Balance	Last Calibration 9/28/05
Digital Ultrasonic Thickness Gauge	Last Calibration 10/13/05
Type K Thermocouple Thermometer	Last Calibration 9/28/05
* Digital Calipers	Last Calibration 1/03/06
* Vernier Calipers 0"-24"	Last Calibration 1/03/06
* Vernier Calipers 0"-40"	Last Calibration 1/03/06
* Vernier Calipers 0"-60"	Last Calibration 1/03/06
Certified Tape Measure	Last Calibration N/A

** Must be calibrated in house by Lane personnel.*

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

III. Test Procedures:

- Sampling:

All personnel responsible for the collection of Q.A. samples from each production line follow the proper collection procedure.

1 2 3 4 5

Comments: Personnel are designated to collect a minimum of 1 sample per each production line every 3 hours or as is instructed by the Q.A. Daily Supervisor. Each individual followed the proper procedure when collecting Q.A. samples.

- Workmanship and Marking:

All personnel responsible to perform frequent checks with regard to the workmanship / marking of the pipe do so as specified.

1 2 3 4 5

Comments: Personnel performed the proper checks for workmanship/markings.

- Weight:

The weight is routinely checked during the production process to ensure that it is within the desired range.

1 2 3 4 5

Comments: Each Q.A. sample is weighed and measured to determine the Weight per Foot (W.P.F.) of each sample. The W.P.F. value is then recorded on the lab W.P.F. log and on the Q.A. Daily Worksheet.

- Liner Thickness:

The test procedure for liner thickness is performed as stipulated in AASHTO M252 / M294.

1 2 3 4 5

Comments: The liner thickness is measured using digital calipers with respect to the procedure in ASTM D 2122 as referenced in AASHTO M 294.

- Inside Diameter Tolerance:

The test procedure for the Inside Diameter Tolerance is performed as stipulated in AASHTO M252 / M294.

1 2 3 4 5

Comments: The inside diameter (I.D.) is measured on each sample that is allocated to the stiffness / flattening test. The test procedure is performed as per AASHTO M 294, section 9.7.1.

- Length:

The test for length is performed as stipulated in AASHTO M252 / M294.

1 2 3 4 5

Comments: Personnel perform the test for length using a tape measure with regard to AASHTO M 294.

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

- Perforations:

The test procedure for evaluating perforated pipe is performed as stipulated in AASHTO M252 / M294.

1 2 3 4 5

Comments: The test for perforated pipe is performed once per production run. Depending on what type of perforated pipe is being produced during the shift (class I or class II), the technician shall examine the dimension of the perforation, as well as the location of the perforations on the pipe.

- Pipe Stiffness and Flattening:

The test for pipe stiffness is performed as stipulated in AASHTO M252 / M294.

1 2 3 4 5

Comments: A minimum of two tests are performed for each week at different orientations using the mold seams as a reference point; 0 degrees, 45 degrees and 90 degrees. The samples are tested using the parallel plate test machine. All results are documented properly for the Q.A. Supervisor on the Q.A. Daily Worksheet.

The test for pipe flattening is performed as stipulated in AASHTO M252 / M294.

1 2 3 4 5

Comments: A minimum of two tests each week are performed to test for flattening. The sample is inspected by the Q.A. Supervisor for wall buckling, cracking, splitting or delamination.

- Environmental Stress Crack Resistance (ESCR):

The test for ESCR is performed as stipulated in AASHTO M252 / M294.

1 2 3 4 5

Comments: The test is performed once per week. Each test is performed on three samples; the Q.A. Technician collects the samples and prepares them for the test by using a strap to decrease the chord length by 20%. The strap is secured and the sample is submersed in an Igepal solution conditioned as per AASHTO M 294 at 118 degrees F to 124 degrees F (50 +/- 2 degrees C) for 24 hours. The sample is then removed from the solution and examined for cracking.

- Brittleness:

The test for brittleness is performed as stipulated in AASHTO M252 / M294.

1 2 3 4 5

Comments: The test for brittleness is performed three times each week. Each test is performed on one sample 24" in length. The sample is then marked with three marks on either side, six inches from each end of the sample, with each mark separated by 120 degrees around the circumference. The sample is conditioned for a period of 24 hours at a constant temperature of 21-28F (-4 +/- 2 C). The sample is then removed and placed in the test apparatus. One impact is made at each mark, or six impacts total. The sample is removed and checked for cracking. Two or more cracks constitute a failure.

- Joint Integrity:

The test for Joint Integrity is performed as stipulated in AASHTO M252 / M294.

1 2 3 4 5

Comments: One sample each week is tested for joint integrity. The sample consists of one 6" pipe with no bell, and one 6" pipe with a bell. The joint is assembled, including the gasket, and is 12" long when assembled. The joint is then compressed in the parallel plate test machine by 20% (the same as the flattening test). The joint is observed for separation of 5mm between the bell and gasket or pipe and gasket.

Lane Enterprises, Inc.
Quality Control // Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

- Test Failures / Non-conformance:

If any pipe is found not to be in conformance with the relevant specification or applicable standard, all employees shall notify the Q.A Supervisor, segregate the nonconforming product and work in conjunction with the Q.A. Supervisor to re-test the product and/or remedy the problem.

1 2 3 4 5

Comments: All employees are aware of their duty to remove non-conforming product.

- Disposal of Non-conforming product:

If it is determined that any product produced does not conform to AASHTO M 252 or AASHTO M 294, respectively, then that product shall be clearly marked, segregated and then reworked

1 2 3 4 5

Comments: All employees are aware of the procedure for marking and removing non-conforming product.
All employees were aware that they must notify the Q.A. Supervisor any time a material is non-conforming.

IV. Reporting Procedures:

- All Q.A. test results are properly documented on the Q.A. Worksheet by the Supervisor or Technician with respect to plant, date, shift of manufacture, production line, lot designation and test results for all test specimens.

1 2 3 4 5

Comments: All test results were reported correctly, all Q.A. Daily Worksheets were signed by the Q.A. Supervisor, test frequencies have changed.

- All test results are to be kept on file for a minimum of 5 years.

1 2 3 4 5

Comments: Q.A. Worksheets were accessible for the past five years, however – test reports are different from year to year depending on the requirements at that time.

Lane Enterprises, Inc.
Quality Control // Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

V. Review of Relevant Standards and Specifying Agency Requirements (SOP Manual):

AASHTO Specifications:

AASHTO M 252 – Standard Specification for Corrugated Polyethylene Pipe (75mm-250mm)

AASHTO M 294 – Standard Specification for Corrugated Polyethylene Pipe (300mm-1500mm)

ASTM Specifications:

ASTM F 412 – Standard Terminology Relating to Plastic Pipe Systems

ASTM F 477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

ASTM F 2136 – Standard Test Method for Notched, Constant Ligament-Stress (NCLS) Test to Determine Slow-Crack-Growth Resistance of HDPE Resins or HDPE Corrugated Pipe

ASTM D 618 – Standard Practice for Conditioning Plastics for Testing

ASTM D 638 – Standard Test Method for Tensile Properties of Plastics

ASTM D 883 – Standard Terminology Relating to Plastics

ASTM D 1238 – Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer

ASTM D 1505 – Standard Test Method for Density of Plastics by the Density-Gradient Technique

ASTM D 1693 – Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics

ASTM D 2122 – Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

ASTM D 2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

ASTM D 2412 – Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading

ASTM D 2444 – Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)

ASTM D 3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

ASTM D 3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

VI. Audit Summary of Findings:

Areas of Improvement and Actions taken:

The Quality Control Program is functioning very well but as with any new program, changes are necessary to satisfy overlooked requirements. Changes were made to the Q.A. Daily Worksheet. Additional line items for verification of AASHTO pipe markings and carbon black compliance were added.

Robert L. Diehl
1/3/06

APPENDIX G

Laboratory Training / Competency Form

Lane Enterprises, Inc.
Quality Control / Quality Assurance Program
HDPE Annular Corrugated Drainage Pipe

Quality Control/Assurance Training/Competency Evaluation

Lab Location: _____

Tr'ee = Trainee, Tr'er = Trainer

Trainee Name:	Weight			Liner Thickness			Inside Diameter			Pipe Length			Brittleness			Workmanship			Carbon Content		
	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial

Trainee Name:	Marking			Perforations			Inlet Area			Pipe Stiffness			Elongation			Resin Melt Index			Resin Density			Resin NCLS		
	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial	Date	Tr'ee Initial	Tr'er Initial

- 1) To attest that the training took place, the initials of both the trainee and the trainer are required.
- 2) The initialing trainer attests that the technician satisfactorily demonstrated the test.
- 3) If the training is due to test method modification, indicate by an asterisk next to the initials of the trainee.